

**REMARKS**

Preliminarily, Applicants respectfully request the Examiner to return initialed Form PTO/SB/08 A & B (modified) for the Information Disclosure Statement filed June 25, 2002. A copy of Form PTO/SB/08 A & B (modified) is attached hereto for the Examiner's convenience.

Claims 1 and 11 have been amended to incorporate therein the recitation of claims 7 and 19, respectively. Claims 7 and 19 have been canceled.

Upon allowance of product claims 1 and 11, Applicants respectfully request rejoinder of withdrawn method claims 22-27 which include all of the limitations of claim 1 and rejoinder of withdrawn method claims 28-36 which include all of the limitations of claim 11. Rejoinder is requested pursuant to MPEP § 821.04 which provides that Applicants are entitled to rejoinder of withdrawn process claims which depend from or otherwise include all of the limitations of the allowable product claims.

Review and reconsideration on the merits are requested.

Claims 1-6, 9-18, 21 and 22 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent 6,106,790 to Hsiung et al. The Examiner considered Hsiung et al as teaching a gas comprising SF<sub>6</sub>, F<sub>2</sub>, NF<sub>3</sub>, O<sub>2</sub>, N<sub>2</sub>, and CF<sub>4</sub>, citing column 2, lines 61-64 and column 3, lines 52-60.

In response, claims 1 and 11 have been amended to incorporate therein the recitation of claims 7 and 19, respectively, to thereby obviate the rejection. Withdrawal is respectfully requested.

Claims 7, 8, 19 and 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hsiung et al. Although acknowledging that Hsiung et al does not specifically teach a gas having the claimed volume ratio ranges, the Examiner cited Hsiung et al as teaching  $\text{NF}_3/\text{N}_2$  ratios said to fall within the presently claimed range. The Examiner further considered such disclosure (column 5, lines 21, 22 and 46) as suggesting that the gas mixtures of Hsiung et al would have a ratio falling within the claimed ranges. Based thereon, the Examiner considered that it would have been obvious to set the gas components to within the claimed ranges for the reason that “discovering the optimum or workable ranges involves only routine skill in the art”.

Applicants traverse, and respectfully request the Examiner to reconsider for the following reasons.

The present invention is directed to a cleaning gas for semiconductor production equipment, which gas is ordinarily used by exciting with microwaves to produce a plasma. The present inventors found that a cleaning gas obtained by mixing  $\text{SF}_6$  and one or both of  $\text{F}_2$  and  $\text{NF}_3$  with an inert gas at a specific ratio has a remarkably improved etching rate and elevated cleaning efficiency. The present inventors also found that cleaning efficiency is further improved by adding an oxygen-containing gas in a specific ratio (page 3, lines 19-28 of the specification). More particularly, in a first embodiment, the cleaning gas comprises an inert gas with any of the following three combinations:

$\text{SF}_6$  and  $\text{F}_2$ ,

$\text{SF}_6$  and  $\text{NF}_3$ , or

$\text{SF}_6$ ,  $\text{F}_2$  and  $\text{NF}_3$ .

The above combinations, as claimed in present claim 1, are described at page 9 of the specification, and the mixing ratio (see, for example, original claim 7 as now combined with claim 1) is described at page 10 of the specification. A second embodiment in which the gas further contains an oxygen-containing gas is described at pages 11-12 of the specification.

Turning to the cited prior art, Hsiung et al relates to a process for destroying or abating  $\text{NF}_3$  contained in a semiconductor exhaust stream to recover one or more of  $\text{N}_2$ ,  $\text{CF}_4$ ,  $\text{CHF}_3$ ,  $\text{SF}_6$  and  $\text{C}_2\text{F}_6$  (Abstract and column 3, lines 52-55). This is done by passing the exhaust gas stream (comprising  $\text{NF}_3$ ,  $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{S}_2$ ,  $\text{CF}_4$ ,  $\text{CHF}_3$ ,  $\text{SF}_6$  and  $\text{C}_2\text{F}_6$ ) through a fluidized bed of metal particles capable of reacting with  $\text{NF}_3$  (claim 1 of Hsiung et al). More particularly, because the semiconductor industry is said to prefer the option of reclaiming and recycling fluorinated compounds for reuse, and because of the close similarity in physical properties of  $\text{NF}_3$  and  $\text{CF}_4$ , separation of these components is difficult such that selective destruction of  $\text{NF}_3$  becomes a logical alternative (column 4, lines 18-23).

However, Hsiung et al does not disclose the cleaning gas of the present invention for removing unnecessary deposits in semiconductor production equipment. Hsiung et al also does not describe or suggest a gas comprising an inert gas with any of the combinations of  $\text{SF}_6$  and  $\text{F}_2$ ;  $\text{SF}_6$  and  $\text{NF}_3$ ; or  $\text{SF}_6$ ,  $\text{F}_2$  and  $\text{NF}_3$  that the inventors found to be highly efficient as a cleaning gas mentioned above.

Claims 1 and 11 have been amended to incorporate therein the recitations of claims 7 and 19. Claims 7 and 19 require more than a ratio of  $\text{F}_2$  and/or  $\text{NF}_3$  to inert gas, but further require such ratio relative to  $\text{SF}_6$  taken as 1. In other words, amended claims 1 and 11 set the relative

ratio of each of  $F_2$  and/or  $NF_3$ , the inert gas and  $SF_6$ . Such ratio cannot be derived from Examples 1, 2 and 4 of Hsiung et al in which a test gas for treating with the fluidized bed of metal particles containing  $NF_3$  and nitrogen is prepared. That is, the cited working Examples of Hsiung et al say nothing about the content of these gases relative to  $SF_6$ .

Additionally, the Examiner found the present claims to be obvious because “discovering the optimum or workable ranges involves only routine skill in the art”. However, such conclusion is unwarranted because Hsiung et al concerns treating an exhaust gas to remove  $NF_3$  such that there is no “optimum or workable range” to discover, let alone determining such range for a cleaning gas of the invention. In other words, there are no parameters to attach to exhaust gas because exhaust gas is whatever happens to be generated during the course of manufacturing. Furthermore, the exhaust gas of Hsiung et al has absolutely nothing to do with the cleaning gas of the invention, such that there is no optimum or workable range to determine for the cleaning gas of the invention based on the exhaust gas of Hsiung et al.

To the contrary, the present invention provides a cleaning gas having a specific ratio of  $F_2$  and/or  $NF_3$  and inert gas taking the volume of  $SF_6$  as one, the use of which improves efficiency in cleaning deposits on semiconductor production equipment.

For the above reasons, it is respectfully submitted that the present claims as amended are patentable over Hsiung et al, and withdrawal of the foregoing rejection under 35 U.S.C. § 102(a) is respectfully requested.

Withdrawal of all rejections, rejoinder of withdrawn method claims 20-36 and allowance of claims 1-6, 8-18 and 20-36 is earnestly solicited.

AMENDMENT UNDER 37 C.F.R. § 1.111  
U.S. Application No.: 10/088,306

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

Respectfully submitted,



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**23373**

CUSTOMER NUMBER

Date: January 19, 2005